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ABSTRACT

Twenty institutionalized adult retardates (10 men, 10 women) were administered paired-associate bigrams (letter-letter, letter-number, number-letter) in an A-B, B-C, A-C paradigm. One-half of the items were designed to enhance positive transfer and one-half negative transfer, and each subject learned both in scrambled (nonsystematized bias) presentations. Furthermore, two A-C lists were used so that the positive-transfer stimulus-items of one list became the negative-transfer stimulus-items of the other list, and vice versa. Each subject learned one A-C list. A 2x2x2 analysis of variance (Sex x List A-C x Transfer) indicated significant differences between positive and negative Transfer (the repeated measure). Post-hoc analyses also related items that were learned fastest, middle or slowest and learners that were quicker or slower with Sex, List A-C, and Transfer. The paper begins with a brief historical review of paired-associate learning. (Author)

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POSITIVE TRANSFER AND NEGATIVE TRANSFER EFFECTS ON PAIRED-ASSOCIATE LEARNING BY RETARDATES CONTROLLED FOR INTELLIGENCE AND ACHIEVEMENT

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Brief History

Philosophers recognized that the conventional laws of association between ideas were in need of supplementation and some suggested the concept of mediated association (Hume, 1886, p. 320; Hamilton, 1861, Vol. 1, pp. 351-354, Vol 2, pp. 244-245). Psychologists also worked with the notion of mediated association with differing definitions and usages (Ebbinghaus, 1885; Wundt, 1894; Titchener, 1910, p. 386; Atherton & Washburn, 1912). Experimental studies of mediated association on a nonverbal level were also conducted (Prokofiev & Zeliony, 1926; Shipley, 1933, 1935; Lumsdaine, 1939; Brogden, 1939).

McGeoch (1942) noted that "The theory of the existence of mediated associations is an old one which has generated more discussion than straightforward experimental study." In his revision of McGeoch's text, Irion (McGeoch & Irion, 1952) saw no good reason for altering that statement.

Peters (1935) and Bugelski and Scharlock (1952) experimentally demonstrated mediation in verbal learning. Peters, using nonsense syllables, found such mediation in two of his nine experiments where the subjects were able to make use of the common item "perceptually or ideationally present at the time of recall." Peters' conclusion indicated that in verbal material, awareness was necessary. Bugelski and Scharlock considered the hypothesis of "unconscious mediated associations" with an A-B, B-C, A-C model. They verified the hypothesis, or at least that the Ss benefited from prior learning of the A-B, B-C lists without reporting any perceptual or ideational use of the material. Russell and Storms (1955) used nonsense syllables paired with words and found that Ss did benefit from mediated associations. Their intermediate steps of mediation had to do with past experience (common cultural

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association chains) and were not learned in the laboratory. In other words, A-B was learned, B-C and C-D were known, and A-D was learned. The Ss could not describe the intervening association items which were assumed to have been operative.

There are many ways that associative strength may operate in paired-associate learning. Russell and Storms presented one way; others have been presented by Gallagher and Reid (1970), Berry and Baumeister (1971), and Wollen and Lowry (1971). Associative mediation, verbal mediation, and positive transfer in paired-associate learning are related to their bipolars, e.g., negative transfer. Spence and Schulz (1965), and Greeno, James, and Da Polito (1971) have evaluated negative transfer. According to the latter authors, negative transfer and forgetting appear to include response competition, associative interference, and unlearning. Intimately related to negative transfer are concepts such as reactive inhibition, proactive inhibition and retroactive inhibition (Briggs, 1954; Johnson & Sowles, 1970; Weaver, Rose, & Campbell, 1971).

Luria (1957) in working with retardates considered them deficient with verbal mediation in paired-associate and other learning. Jensen and Rohwer (1963) probed paired-associate and serial learning in an attempt to resolve differences between these two forms of rote learning. Serial structure and its effect on paired-associate learning was appraised by Pollio and Draper (1966). Luria has presented the notion that retardates do poorly in some learning tasks because of the lack of association between verbal and motor behavior. Various signal systems were analyzed in several studies by O'Connor and Hermelin (1963). Working in this area, Milgram (1968a) controlled for the effect of

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mental age and intelligence quotient.

Underwood et al. (1959, 1960) developed a two-stage model of paired-associate learning: response learning and associative learning. Research with this model has been conducted by Prehm and Stinnett (1970); Kellas and Butterfield (1970); and Berry, Baumeister, and Detterman (1971). An issue was raised by Maccoby (1964) as to whether retardates showed a production deficiency or a mediation deficiency. Ellis (1963) formulated a stimulus trace theory to explain retardation and behavioral inadequacy. In the same book, Zeaman and House (1963) consider the role of attention in retardate learning.

Temporal factors have been researched with regard to stimulus-response duration (Nodine, 1969) and interstimulus interval (Murray, 1970). Recall or relearning for one day (Prehm & Mayfield, 1970) or one week (Hawker & Keilman, 1969) were duly noted. Melton (1967) and von Wright (1971) examined the problem of repetition and memory retrieval, massed practice and distributed practice. The speed of learning has also been considered a variable in storage and retrival. Schieble (1954), Mandler and Huttenlocher (1956), and Underwood and Schulz (1960) investigated this variable.

Verbal transfer and directionality, i.e., forward and backward association, has been studied by Harcum (1953) and Schild and Battig (1966). Asch and Ebenholtz (1962) developed a principle of associative symmetry and a notion of conceptual symmetry which could include conceptual and logical reversals.

Retardates are considered ideal for paired-associate research since they appear to de-emphasize the spontaneous use of verbal mediators (Jensen & Rohwer, 1963).

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The verbal mediators can be built into the study and thereby add control. Clark, Lansford, and Dallenbach (1960) used letter-numeral pairs and their subjects had a difficult time inventing verbal mediators to enhance the association within pairs. Related to this associationism are rehearsal (Leicht & Johnson, 1970) or recital (Milgram, 1968b) instructions. Turner and Walsh (1971) used word, sentence, and paragraph mediation, including some reversals.

The present experiment investigated the effects of positive transfer (associative mediation, verbal mediation) and negative transfer on the learning of letter-letter, letter-number, or number-letter pairs. The Ss were institutionalized adult retardates, 10 men and 10 women, 20-34 years of age, controlled for intelligence and academic achievement.

Method

Subjects

The pool of subjects used in this experiment were 20-34 years of age, could read letters and numbers, had borderline intelligence on a verbal Wechsler Adult Intelligence Scale, and were institutionalized at Glenwood State Hospital-School in Iowa. Initially a group was randomly selected from the pool for a pilot study to determine the efficacy of materials and procedure. The remaining subjects were stratified as to sex, from which ten men and ten women were randomly chosen to participate.

There were no significant differences between sexes on the Wechsler Adult Intelligence Scale Verbal IQ ($\bar{x}$ = 76, SD =3.0 versus $\bar{x}$ = 74, SD = 4.4), or on the Wide Range Achievement Test Reading ($\bar{x}$ = 4.4, SD = 1.3 versus $\bar{x}$ = 4.7, SD = 2.3), though women were more variable. However, corresponding IQs on the Stanford Binet Intelligence Scale (Form L-M) placed the Ss in the mildly retarded (rather than border-

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line) category of intelligence. This was expected (e.g., see Cochran & Pedrini, 1969).

Materials

The paired-associate lists consisted of letter-letter, number-letter, or letter-number combinations. The lists followed an A-B, B-C, A-C model and each list included six pairs. For a discussions of paradigms, controls, and pseudomediation controls, refer to Mandler and Earhard (1964). The A-B and B-C lists are presented in Table 1 and for each subject each list was scrambled (i.e., mixed with non-systematized bias). There were two A-C lists and they are presented in Table 2. Three items in each A-C list were the experimental (alleged positive transfer) items. Three items in each A-C list were the control

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Insert Table 1 about here

Insert Table 2 about here

(alleged negative transfer) items. One A-C list was designated "blue," the other A-C list was designated "red." The experimental stimulus-items of the blue list were used as the control stimulus-items of the red list, and vice versa (see Table 2). The letters and numbers originally printed in black on clear plastic were made into two-by-two inch slides and used with a carrousel projector. The projected images were clearly legible and the same equipment and room were used with each subject.

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Procedure

Prior to the experiment proper, the subjects were taught prototypical tasks through a series of three-by-five cards. During the experiment, per se, a carrousel projector was used, adjusted so that it would present each slide for five seconds, with a five-second pause between slides. The subjects responded verbally, i.e., reading or reading and guessing for each trial. Errors in reading (if any) were corrected by the experimenter. Errors in guessing were corrected by the slide (automatically showing the required association). Prior to the first presentation of list A-B, the experimenter said, "Get ready, see how many you can learn." The initial correct response in the A-B list was reinforced with "Good." After the first run through of the paired-associate list A-B, the experimenter said, "Get ready, see how many you can remember or learn." Response to the stimulus was by the method of anticipation. After each run through, the slides were scrambled (i.e., mixed into non-systematic bias) during a two-minute rest period. After each paired associate was learned to a criterion of five correct (but not necessarily consecutive) trials, the paired associate was eliminated from the list. Eventually each paired associate was learned.

There was a ten-minute rest period between the lists. The same learning procedure was required of each subject for each list (A-B, B-C, and either blue A-C or red A-C).

Results and Discussion

The paired-associate data were analyzed (Winer, 1971, pp. 559-569) using a three-factor (2x2x2) analysis of variance design (fixed factors: Sex, List A-C, Transfer) with repeated measures on

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one factor (Transfer). The experimental (alleged positive Transfer) items shared a common response which enhanced paired-associate learning. The control (alleged negative Transfer) items shared response competition, associative interference, and/or the need for unlearning an old response prior to learning a new one. For trials required to achieve criterion, the positive Transfer items differed significantly from the negative Transfer items ($F=10.96$, 1/16 df, $p < .005$). The positive Transfer items (controlled through the use of blue versus red lists) required significantly fewer trials to criterion. There were no other significant differences in the three-factor analysis.

An interview was conducted with each subject after his or her part in the experiment. One subject (woman, red list) rehearsed between trials. None of the subjects ($n=20$) reported the use of mediating syllables in their attempts to learn List A-C. They were naive subjects and appeared to have no insight as to the basic purpose of the experiment.

The analysis of variance model reported above had been determined pre-hoc. But how do items of positive and negative Transfer relate to Items that were learned fastest, middle, or slowest? How do they in turn relate to quicker or slower Learners for Sex or for List A-C? The answers to some of these questions may be gleaned from post-hoc analyses of variance presented in Table 3. Data were analyzed using a four-factor (2x2x2x3) partially-nested analysis of variance fixed-factor design. One design included Sex, Learners (nested under Sex), Transfer, and Items: the other

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Insert Table 3 about here

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included List A-C, Learners (nested under List A-C), Transfer, and Items. The factors of Transfer and Items are repeated measures. Transfer includes the positive and negative items discussed previously. Items (subsumed under Transfer) includes the fastest, middle or slowest items learned. When tied ranks appeared, a cube was cast for inclusion into a category. The Learners were nested under Factor A and grouped into quicker (more rapid learners) or slower learners.

It is obvious in Table 3 that there were significant main effects of Learners (nested within A) into quicker and slower; of Transfer into positive and negative; and of Items into fastest, middle, and slowest. This should not be surprising since Transfer showed itself significantly differentiated previously (three-factor analysis), and since differences were sought for Learners and Items (through post-hoc grouping techniques). Sex differences are not apparent, nor were they previously (three-factor analysis). However, List A-C differences which tended towards significance previously ($F=3.09$, 1/16 df, $p < .10$), now achieve significance ($F=13.72$, 1/16 df, $p < .005$). Of course, the Table 3 analysis is post-hoc, but it may point up a potential difference. The blue list required more trials to criterion. Significant differences in lists (blue versus red) were not indicated for the background, controlled variables of Wechsler Adult Intelligence Scale Verbal IQ ($\bar{x}=75$, $SD=3.6$ versus $\bar{x}=76$, $SD=4.1$) or Wide Range Achievement Test Reading ($\bar{x}=4.3$, $SD=1.8$ versus $\bar{x}=4.9$, $SD=2.0$).

Of the interactive effects (see Table 3), Items X Learners (nested within A) was significant. A consistent, ordered relationship was noted among Items that were fastest, middle, or slowest and Learners that were quicker or slower (data not shown). The quicker Learners

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were quicker with the fastest, with the middle, and with the slowest Items as contrasted to the slower Learners.

There was a significant Transfer (positive, negative) x Items (fastest, middle, slowest) interaction. For the fastest Items there were no significant differences between positive Transfer and negative Transfer (data not shown). This was probably the result of a ceiling effect. However, differences between positive Transfer and negative Transfer were apparent for the middle Items, and the differences increased for the slowest Items.

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Table 1

Paired-Associate Lists A-B and B-C

List A-B		List B-C	
7	7-C	N	N-5
S	S-1	2	2-H
R	R-2	1	1-L
M	M-V	C	C-J
8	8-B	V	V-6
W	W-N	B	B-F

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Table 2

Paired-Associate Lists A-C

List A-C (blue)		
R	R-H	(exper.)
8	8-F	(exper.)
S	S-5	(control)
M	M-6	(exper.)
W	W-J	(control)
7	7-L	(control)

List A-C (red)		
8	8-H	(control)
7	7-J	(exper.)
S	S-L	(exper.)
W	W-5	(exper.)
R	R-6	(control)
M	M-F	(control)

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Table 3

Analyses of Variance Concerning Sex (Men, Women) or List A-C (Blue, Red) and Learners (Quicker, Tarrier) for Transfer (Positive, Negative) and Items (Fastest, Middle, Slowest)

Source of Variation	df	Sex MS	Sex F	List A-C MS	List A-C F
Among subjects	19				
A (Sex or List A-C)	1	12.67	2.43	31.00	13.72***
Learners (nested within A)	2	56.31	10.79***	70.82	31.34***
Error among	16	5.22		2.26	
Within subjects	100				
Transfer	1	11.42	8.33*	11.42	9.14**
Transfer X A	1	.67		2.41	1.93
Transfer X Learners (nested within A)	2	.25		.30	
Error within transfer	16	1.37		1.25	
Items	2	45.21	54.47***	45.21	61.09***
Items X A	2	.18		1.66	2.24
Items X Learners (nested within A)	4	2.56	3.08*	2.58	3.49*
Error within items	32	.83		.74	
Transfer X Items	2	2.50	5.43**	2.50	6.10**
Transfer X Items X A	2	.18		.86	2.10
Transfer X Items X Learners (nested within A)	4	.24		.34	
Error within transfer X items	32	.46		.41	

* $p < .05$
** $p < .01$